SYSTEM FOR OPERATING AND MONITORING HAVING INTEGRATED HISTORIAN FUNCTIONALITY

CROSS REFERENCE TO RELATED APPLICATIONS

This application is the US National Stage of International Application No. PCT/DE2003/002887, filed September 1, 2003 and claims the benefit thereof. The International Application claims the benefits of German application No. 10243065.9 filed September 16, 2002, both applications are incorporated by reference herein in their entirety.

FIELD OF THE INVENTION

The invention relates to a system for operating and monitoring a production process, said system having an integrated database for filing the process information data.

In modern production installations, in particular in the processing industry, ever-increasing volumes of data arise during the production process owing to the growing use of intelligent field devices. Said data is used partially directly in systems for operating and monitoring (also HMI or SCADA systems) for monitoring and controlling the respective production process. Data concerning the production process is, however, similarly also used by what are termed historian systems or, as the case may be, systems for managing the plant information (Plant Information Management System, PIMS) in such a manner that the data is filed in high-performance databases and is available for subsequent analysis with the aid of statistical evaluation systems.

The systems currently employed for operating and monitoring (O&M systems) therefore acquire process data in order to display the momentary values in, for example, graphical form. The O&M systems moreover also generate alarms and events from the data. They also file the process values, insofar as is necessary for a subsequent display. Filing typically takes place in a proprietary manner in a separate file system.

Graphical representing of the process data can be carried out
on what are termed O&M clients. Proprietary interfaces are as
a rule employed for this. It is extremely important for O&M
systems to ensure high-availability plant operation at all
times. They therefore offer highly developed redundancy
mechanisms and allow the functionality to be distributed even
over the internet. Large systems for operating and monitoring
are, moreover, frequently distributed systems in order to take
the plant's topology into account. As a result, data logging,
report derivation, and filing are also distributed. However,
systems for operating and monitoring offer mechanisms for the
clients rendering this distribution transparent.

The plant information management systems (PIMS) used by
industry today serve to acquire process data very fast and
centrally. Said data is as a rule stored in a database. The
clients of said systems, for example simple database clients,
will then be able to interrogate said data later via standard
interfaces (ODBC, OLE DB, ADO, SQL, and the like) and further
process it. The main focus here is on accessing via a generic
interface. Redundancy mechanisms and accessing of the
historical data over the internet are non-existent.

SUMMARY OF THE INVENTION

O&M and historian systems both access the same process data.
The required data therefore has to be fetched twice from the
relevant data sources. This burdens both the data sources,
which is to say control devices and sensors, and the
respective communication paths such as, for example, networks.
The data used by the two systems is not synchronized because
the acquiring system as a rule issues a time stamp and
synchronizing between both systems or, as the case may be,
time stamps would require a substantial expenditure. The
currently necessary double configuring of the overall system
is also demanding in terms of expenditure because, for
example, acquisition cycles have to be planned twice. The
redundancy and the transparency of distribution in the logging

and filing of process data that are made available by, for example, an O&M system are not used for the historian clients and can only be implemented by means of expenditure-intensive cluster mechanisms (of the operating system or database), hardware redundancy, and explicit distribution planning. Internet access to the historian database supported by network mechanisms such as proxy servers or firewalls is not possible over the standard interfaces, such as, for example, ODBC.

The object of the invention is to disclose a system enabling simple and non-site-specific operation and monitoring of a plant and serving simultaneously to permanently file and/or archive process data for analysis and the application of evaluation methods.

Said object is achieved by means of a system for operating and monitoring a production process, said system having first means for provisioning automation devices or, as the case may be, systems and/or diagnostic devices or, as the case may be, systems and/or further devices for acquiring process information data, a device for editing and/or representing the acquired process information data for at least one user of the system, and a historian database for filing the acquired process information data for evaluating and/or representing the filed process information data.

The invention is based on the knowledge that the separation currently prevailing between the systems for operating and monitoring a plant or, as the case may be, a process and the plant information management systems, which is to say the historian systems, gives rise to increased expenditure requirements in acquiring the process data or in the planning of, for example, process communication or a security system.

The advantage of the presented embodiment according to the invention is that the characteristics or, as the case may be, advantages of O&M systems and historian systems are combined.

The system for operating and monitoring is herein expanded in
such a manner as to offer historian functionality in addition
to its original functionality and also vice versa. This means
that the O&M process communication is used to file the
acquired process information data on a high-performance basis
in a database contained locally in the HMI or, as the case may
be, vice versa, that the data acquired by the historian system
for long-term filing is used in an integrated O&M system. The
O&M system herein co-assumes the functions of the hitherto
separate filing system or, as the case may be, vice versa. An
efficient historian is hence combined with the functionalities
of a modern HMI system. A scalable historian functionality is
thereby available ranging from a simple HMI standalone system
to a cross-corporate solution that is also used in process
control systems. The database herein serves as a central
information exchange in a company or, as the case may be, for
a plant and places particular requirements on performance,
availability, and security. Efficient mechanisms are
implemented herein that far exceed the function of a standard
database and render the database suitable for industrial use
without having to accept the limitations in terms of the
openness and standard of, for example, a Microsoft SQL server.
Data compression, various options for redundancy that is
transparent for the application and for users, online
modifiability, and long-term filing are integrated in the
basic system. Expensive duplicate entries and the time-
consuming maintenance of planning data are effectively
obviated as the historian is an integral part of the HMI
system. Data is acquired from the automation systems via
standard interfaces, or also from databases, then aggregated
and filed. The consequence of linking the HMI and historian
into a single application is also, however, that data has to
be acquired only once from the information sources, which is
to say the automation devices or, as the case may be,
diagnostic devices. This results in reduced loading of the
network and sources. It furthermore ensures consistency of the
filed data. [lacuna] have a possibility of logging and

displaying the security status. Plant operators are hereby
enabled at all times to monitor the security status of parts
of their plant's automation.

A further advantageous embodiment of the invention is
characterized in that the system is provided for coupling to
the automation devices or, as the case may be, systems and/or
diagnostic devices or, as the case may be, systems and/or
further devices via a data transmission device. The system
according to the invention can be installed at any location on
the plant and receives the necessary process information data
for example over an Ethernet, a bus system, or any other
device serving to transmit data from the field devices to the
O&M system. Alongside its non-site-specific characteristic,
the system's flexibility is also advantageous since additional
field devices can be connected to the data transmission device
at any time.

A further advantageous embodiment of the invention is
characterized in that the system has second means for
generating alarms and/or events. The integration of a security
system of said type which makes the acquired real-time
information data available for generating alarms or events for
an operator and monitor of the plant as a function of the
respective planning is advantageous since a plant operator can
be immediately warned if certain parameters within the
production process do not accord with the requirements. The
operator will be able to react immediately and intervene in
the production process or, as the case may be, re-adjust a
should-be value in the event of a false alarm. The system for
operating and monitoring thus draws a plant operator's
attention, by means of particular information, to the fact
that a certain situation has arisen, possibly an exceptional
situation, requiring an immediate response on the part of the
plant operator.

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A further advantageous embodiment of the invention is
characterized in that the system has at least one interface
for communicating with at least one client. It is herein
advantageous that a plant operator does not have to work
directly on a PC or [lacuna] on which the system for operating
and monitoring the plant is installed. The real-time data and
its corresponding graphical representation can also be
accessed from a client at any other location. A certain degree
of mobility is thereby provided in operating the plant. Said
embodiment of the invention furthermore has the advantage that
in the case of a distributed plant the actual HMI system has
to be installed only once on an efficient machine, while plant
operators are able to access said system independently of each
other from several clients. Distributed operation of the
system is hence also made possible.

A further advantageous embodiment of the invention is
characterized in that the client is provided as a web client
for communicating over the internet and/or an intranet. The
advantage of this embodiment of the invention is that the
process information data for operating and monitoring can also
be accessed from remoter locations, for example when a plant
consists of a plurality of sub-plants or when a company is
spread across different locations. Company management is
thereby enabled also to call up the production data centrally.

A further advantageous embodiment of the invention is
characterized in that a browser is provided as the web client.
It is advantageous when a browser is used that any internet-
enabled client can be employed for using the system for
operating and monitoring a plant. The client can hence be what
is termed a thin client. The evaluation functionality required
for the system for operating and monitoring is herein made
available by the system for operating and monitoring itself
via a communication network, which is to say, for example,
over the www. Availability of information is thus ensured at

any time and at any location through the use of a simple web
browser.

A further advantageous embodiment of the invention is
characterized in that the clients and/or the web clients are
embodied as SCADA clients of the system for operating and
monitoring. It is herein advantageous that SCADA clients
already installed for operating and monitoring the system can
also be used in the future for, for example, accessing the
filed data newly stored in the system via the clients. The
SCADA clients thus also serve as operating stations for the
filing system. In addition to access to the current plant
status, historical process data and alarms are also made
visible for the user via the client in the form of trends and
tables. Already existing analysis functionalities, such as
filter conditions and sorting criteria in the client's various
visualizing objects, are herein also available.

A further advantageous embodiment of the invention is
characterized in that the clients and/or the web clients are
embodied as clients that are independent of the system for
operating and monitoring. It is herein advantageous that
independent clients, what are termed 3rd-party components,
which is to say, for instance, typical historian clients, have
access to the filing system via the system for operating and
monitoring a plant. It is therefore not necessary to replace
any already existing historian clients having special
analyzing and evaluating functionality. Said clients are
supplied with the relevant process information data by way of
remoting of, for example, the standard interfaces of the
database. Accessing can, however, also take place herein via
the proprietary interfaces of a system for operating and
monitoring. Using the special historian clients as, for
example, analysis clients is advantageous for analyzing the
optimizing potential in the process. Data analyzing can be
performed not only interactively but also as being triggered
by events within the various processes within the company.

Combining the system for operating and monitoring a plant with
the historian system and with the possibility of representing
the combined system's data in a special analysis client
ensures a better overview at all times of the relevant
company.

A further advantageous embodiment of the invention is
characterized in that the independent clients are embodied as
historian clients having analyzing and/or statistical and/or
graphical functionality for evaluating and/or representing the
filed process information data. Use of the relevant clients
as, for example, report clients for printing and displaying
pre-designed reports containing online data and historical
data from all levels within a company is advantageous. Any
data from databases, 3rd-party applications, and also from the
automation level can herein be included.

A further advantageous embodiment of the invention is
characterized in that the functionality of the independent
clients is integrated in the SCADA clients of the system for
operating and monitoring. In this advantageous embodiment an
analysis client's highly complex analyzing functionality and
graphical functionality, for example, used specifically in a
historian system is included in the user interface of the
system for operating and monitoring. This enables the system
for operating and monitoring to be used in such a manner with
a single representation or, as the case may be, from a single
client that the plant can be operated and monitored and that
an overview of the historical filed data, which is to say, for
example, trends, can simultaneously be provided extending over
a number of years. The advantage herein is that it is not
necessary to install different clients having different
functionalities, which factor primarily constitutes an
economical solution. It is, however, furthermore advantageous
for a plant operator in, for example, an alarm situation
requiring a response from said operator simultaneously to be
able to access filed data and trends so as thereby to utilize

available knowledge about the production process as experience
for the response that is made. Using a combined client of this
type thus makes it possible to provide the operator with a
"process information data knowledgebase" at any time.

A further advantageous embodiment of the invention is
characterized in that the functionality of the SCADA clients
is integrated in the independent clients. Said embodiment
enables standard clients as well as special clients suitable
for data analysis to be used simultaneously for representing
the functions specific to an O&M system. Monitoring and
operating of the plant by, for example, a historian client is
made possible since the special O&M user interface is
integrated. Active intervention in the production process from
the same client is also possible alongside passive information
processing.

A further advantageous embodiment of the invention is
characterized in that the functionality of the clients is
integrated in standard applications, in particular office
applications. Said embodiment makes it possible to implement
what are termed management clients for displaying the
historical data on standard office PCs having standard tools
such as, for example, Microsoft Excel, so that company manage-
ment can, whenever required, obtain an overview of the
situation in the production sector at different times or, as
the case may be, across different periods of time. Special
pre-designed reports containing data compiled for management
can herein be represented by the standard office applications.
An overview, including one covering a company's various
production sites, can therefore be generated at any time and
anywhere on a standard PC.

A further advantageous embodiment of the invention is
characterized in that the database is provided for fast and/or
central filing of the acquired process information data. The
database used for filing the process information data must be

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of high-performance type since process data comprising
thousands of individual items has to be written into the
system in a short time and filed there. Special requirements
are therefore placed both on the performance of a database of
said type and on its availability and security. In particular
the structure of employing a central database is advantageous
alongside high performance. Synchronicity of the filed data is
ensured thereby. It is furthermore ensured that all consumers
of information will access a uniform data inventory. A
distributed storing of data and the attendant problem of
synchronizing are avoided by means of said central database
and the storing of data is achieved in an advantageous manner.

A further advantageous embodiment of the system is
characterized in that the database is embodied as a relational
database. High-speed storage facilities and data accessing are
ensured thereby.

A further advantageous embodiment of the invention is
characterized in that access to the database is provided by
means of SQL queries via standard interfaces. It is herein
advantageous that standard Microsoft technology can be
employed. A Microsoft SQL server, for example, can be used for
the database, with its then being possible for accessing to
take place via, for example, OLE-DB, OPC, COM. The special
development or, as the case may be, programming of specific
interfaces to allow access to the database is rendered
superfluous by this advantageous embodiment of the invention.

A further advantageous embodiment of the invention is
characterized in that the process information data filed in
the database is provided for accessing by clients
communicating with the system. The clients, which is to say,
for example, SCADA clients or special analysis clients, can
directly access the data which is stored in the filing
database. Direct provisioning of the respective users with
filed process data is ensured thereby. External relocating of

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the data, buffering within a further system or in the system
for operating and monitoring, and other intricate methods or
mechanisms for making the data available are thereby rendered
unnecessary. Rather it is the case that the data is accessed
directly.

A further advantageous embodiment of the system is
characterized in that remoting of the standard interfaces of
the database (4) is provided. Remoting the standardized
database interfaces (ODBC, OLE DB, ADO, SQL, and the like)
makes it possible to use commercially available historian
clients in remote internet scenarios. The clients can access
the process information data directly.

A further advantageous embodiment of the system is
characterized in that the system and the clients are provided
for bi-directional web communication. Clients and the system
for operating and monitoring can thus communicate with each
other using standard HTTP protocols. It is herein advantageous
that communication is bi-directional, which is to say the
clients can, temporally independently in a process triggered
by the server without a client request, both receive and
appropriately represent data from the system for operating and
monitoring and also send instructions to the system for
operating and monitoring a plant which will then be executed
there accordingly and, in certain circumstances, influence the
production process. The production process can therefore as a
result of this advantageous embodiment also be controlled
remotely.

A further advantageous embodiment of the invention is
characterized in that the clients are provided for entering
specifications and/or should-be values for controlling the
production process. It is herein advantageous that it is also
possible for special values serving as, for example, threshold
values for generating alarms and/or events to be changed or,
as the case may be, adjusted remotely by the respective

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clients. Remote tuning of the plant is made possible by this
advantageous embodiment.

A further advantageous embodiment of the invention is
characterized in that the system for operating and monitoring
is provided for managing users of the system and/or for
planning process communication and/or a security system. It is
herein advantageous that, for example, user rights and access
rights are administered directly within and by the system. The
system itself therefore has information as to whether, for
instance, a specific user is authorized to re-adjust a should-
be value for, for example, triggering an alarm. The system
furthermore enables uniform planning of, for example,
communication structures or the security system. It is herein
particularly advantageous that within the system the
structures have to be planned only once and will thereafter be
available for both the historian system and the system for
operating and monitoring. Time-consuming duplicated planning
is thereby rendered superfluous.

A further advantageous embodiment of the invention is
characterized in that the system for operating and monitoring
is of redundant design, with redundancy also existing for
independent clients. Operation and monitoring of a plant
having to be provided by the system at all times, a major
prerequisite is for highly-developed redundancy mechanisms to
be present in the system. Fast access to the data acquired
from the automation systems or, as the case may be, diagnostic
devices must be ensured so that working can resume immediately
in the event of a total outage. Redundancy can herein be
implemented by imaging the data in the system or by employing
redundant hardware, such as servers, and through duplicated
interrogation of the process information data from the
sources. Additional burdening of the data lines is avoided
when imaging is employed as the respective process information
data has to be acquired once only. The historian system

benefits in the case of the system according to the invention
from the 'redundancy present in any event in the O&M system.

A further advantageous embodiment of the invention is
characterized in that at least one multiplexer component is
provided for concealing the redundancy and/or a plurality of
data servers. The redundancy mechanisms (changeover of the
servers/data sources) are transparent for the client.
Concealment takes place in servers or in intermediate layers
(proxies, multiplexers). In the event of an outage of, for
example, a server, changeover will thereby be effected
automatically to a redundant server and the users on the
clients will continue to be supplied with the relevant
information. They will not be affected by the component outage
and no special measures will have to be launched to switch to
the redundant server. Rather it is the case that changeover
will take place without the clients' being apprised of the
outage by the multiplexer.

The invention is described and explained in more detail below
with the aid of the exemplary embodiment shown in the sole
figure:

BRIEF DESCRIPTION OF THE DRAWING
FIG 1   shows a system for operating and monitoring a
         production process, said system having integrated
         historian functionality.

DETAILED DESCRIPTION OF THE INVENTION
The system 1 acquires process information data PI from a
production process PP. Said process information data PI comes
from automation devices or, as the case may be, diagnostic
devices 5. These can be control devices or sensors. The
process information data PI is transmitted to the system 1
over a data transmission device 6. Said data transmission
device 6 can be, for example, a bus system. The data is made
available by the means 2 for real-time provisioning for use in

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the system 1. A device 3 for editing or representing the
acquired process information data PI is present in the system
1. There is furthermore a database 4 for filing the acquired
process information data PI. Said database can be a SQL
server. The process information data can be used by further
means 7 for generating alarms or events. The system 1 can
communicate with clients 9, 9a, 99, 99a via an interface 8.
This communication can take place over the internet 10. A
multiplexer 11 enables concealment in the case of redundancy
and/or a plurality of data servers.

In the exemplary embodiment of the invention shown in the
figure the process data PI collected by automation devices or,
as the case may be, diagnostic devices 5 during a production
process PP is forwarded directly to a system for operating and
monitoring 1. Alongside the use of bus systems, any
communication networks such as, for example, transmission over
the internet, is herein also conceivable as the data
transmission device 6. The process information data PI is used
by the system 1 for operating and monitoring to represent a
current plant status for a user. A user can as a rule also
influence the relevant production process PP via the system 1
by being able to address the control devices via the data
transmission device 6. The re-adjustment of should-be values
is, for example, herein conceivable. Similarly, it is possible
via the system 1 for operating and monitoring to, for example,
influence supplied quantities of various basic materials
employed in the production process.

The system 1 is able to produce alarms or events on the basis
of the acquired process data PP to make the user aware of
special situations. Simple analyses of the process data are
therefore possible through the means 7 for producing said
alarms and events.

An extensive analysis of production processes over a longer
period of time is likewise enabled by the system 1 as a result

of the filing of all process information data PI within the
system 1 on a database 4. All measurements taken from the
production process are stored in the database 4. Fast access
to the historical data also describing a production process PP
over a longer period of time is thus possible at any time over
the system for operating and monitoring. Analysis such as, for
example, comparing different batches, is hereby made possible
by the system 1.

The process information data PI acquired from the automation
devices or, as the case may be, diagnostic devices 5 is
therefore used by the system both for representing the current
plant status and for filing for the purpose of subsequent
detailed analysis. The data therefore has to be collected once
only.

Any clients 9 such as, for example, special clients for
operating and monitoring such as SCADA clients or web-enabled
clients 9a such as, for example, a web navigator for a system
for operating and monitoring can be connected to the system 1
via a proprietary interface 8. Independent clients 99, 99a
themselves contributing special functionality but not equipped
directly with functionality for operating and monitoring can
also be connected to the system 1 via a proprietary interface
8 and can access process information data PI. The data filed
in the database 4 can hereby be represented and processed on,
for example, special analysis clients possessing specific
evaluating, analyzing, statistical, and graphical
functionality.

Standard programs such as, for example, an office environment
from Microsoft, can likewise be used. The provision of global
information about the plant's current status and about the
plant's history with reference to the production process is
consequently possible at any time. Access can herein be
effected on the one hand via the proprietary O&M interfaces

and, on the other hand, also through remoting the relevant
generic database interfaces.

A hybrid interface enabling direct access to the data of the
database 4 and access to data of the system 1 for operating
and monitoring is also conceivable. The system 1 overall
enables a plant's process information data PI to be accessed
at any time and anywhere over clients 9,9a,99,99a of
multifarious kinds for the purpose, on the one hand, of
operating the plant and, on the other hand, of supplying
information.

To summarize, the invention relates to a system 1 for
operating and monitoring a production process PP and for
filing process data for a historian system. O&M functionality
and historian functionality are integrated in a system 1. A
historian database 4 serves to store process information data
PI. Accessing of the production process PP and accessing of
data filed on a long-term basis is enabled in one system 1.
The process information data PI has to be collected once only
by the respective devices 5. The historian system benefits
from the O&M system's redundancy. Special multiplexer
components 11 ensure transparent concealment of underlying
systems. The system 1 is internet-enabled 10 and suitable for
use by any clients 9,9a,99,99a. Remoting of the database
interfaces enables the use of commercially available historian
clients in internet scenarios.